

QUICKIA ALDABRAENSIS (MOLLUSCA,
GASTROPODA: PULMONATA, SUCCINEIDAE),
A NEW SPECIES OF LAND SNAIL FROM
ALDABRA ATOLL, WESTERN INDIAN OCEAN

By C. M. PATTERSON

INTRODUCTION

THE Succineidae, a rather diverse land snail family, currently includes 12 recent genera (Patterson, 1971, 1973a). *Succinea*, *Oxyloma* and *Catinella* have received the most attention by researchers, while representatives of the remaining genera have scarcely been studied. *Quickia* is distinguished from other succineids by the position of the right tentacular assembly (situated entirely to the inside of the terminal genitalia) combined with the lack of a penial sheath and penial appendix. Some unique features of *Quickia* were first reported by H. E. Quick (1936), but the genus was not named formally until 14 years later by Odhner (1950). The distribution of *Quickia* given by Odhner was '... from Liberia to the Cameroons and Gabon, on Prince Island and San Thome to East Africa (Zanzibar and Mauritius, as well as, according to Madge, 1938, Rodriguez, Reunion and the Seychelles).' Subsequently, *Quickia* received no further attention until the reproductive anatomy and chromosome number of *Q. spurca* (Gould) was described (Patterson, 1968). Following that, the existence of *Quickia* in India was reported in a morphological and cytological study of two Indian species (Patterson, 1970). In addition to its unique genital morphology, *Quickia* is of cytological interest because all five species studied have 25 pairs of chromosomes, the highest number known in the Succineidae.

The objectives of this report are (1) to describe a new species of *Quickia* from the Indian Ocean island (atoll) of Aldabra and to record its chromosome number; (2) to briefly review the distribution of *Quickia* and (3) to discuss some aspects of the biology and systematics of the genus.

MATERIALS AND METHODS

Several living specimens of *Quickia aldabraensis* were forwarded to me by C. A. Wright of the British Museum (Natural History) in January 1968. Eleven successive generations were produced during the following two years. Methods of laboratory culture are described in Patterson (1971, 1972). The following locality data and habitat description were provided by J. F. Peake (personal communication) also of the British Museum (Natural History). The specimens were collected by J. D. Taylor while participating in the Royal Society Expedition (1967-68) to Aldabra Atoll. The snails were found on the plain area at the eastern end of South Island (Fig. 1) where the surface limestone is impervious to rain water. They were observed

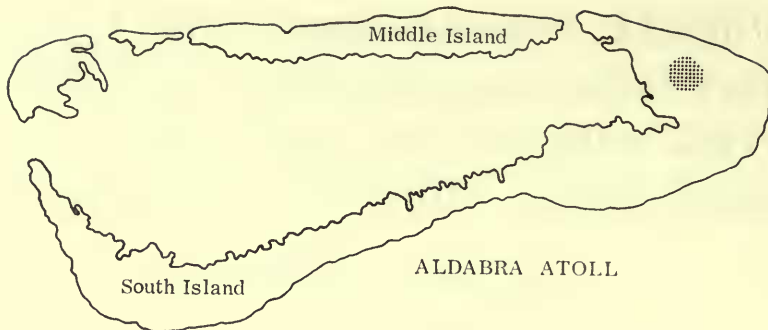


FIG. 1. Collecting site for *Quickia aldabraensis*.

variously in areas of short grass, bare rock or close to pools of fresh or somewhat brackish water. They were also found hidden under rock slabs, in cracks or other places of probable protection from desiccation. The climate of Aldabra Atoll is dry for most of the year with a short wet period which does not necessarily occur regularly.

Dissections of relaxed, alcohol-preserved specimens were made under $120\times$ or $250\times$ magnification using a Wild M5 stereoscopic microscope. All drawings were prepared with the aid of a camera lucida attachment. For details of specimen preparation and dissection see Patterson (1971).

SPECIES DESCRIPTION AND OBSERVATIONS

Quickia aldabraensis, sp. n.

Shell

Shells from both field-collected and laboratory-reared *Quickia aldabraensis* vary from attenuate to somewhat more ovate (Plate 1 and Figs. 3, 4). The same kind of variation was noted among *Q. spurca* shells (Patterson, 1968). The attenuate form of adult laboratory-reared *Q. aldabraensis* has three whorls and measures 8.5–9 mm in height and 4.5–5 mm in width. The teardrop-shaped aperture is 5.75–6 mm high and 4 mm wide. More ovate shells measure 8.5–9 mm in height, 5.5–6 mm in width and have an aperture 6 mm high and 4 mm wide. The largest shells may reach a height of 10 mm. Large adult shells collected from the field (Fig. 3) were comparable in size to those reared in the laboratory. Shells cleansed with sodium hypochlorite have a translucent light amber colour. Mud was adherent to most shells obtained from the field and appeared to be arranged in three spiral ridges on some specimens while no definite arrangement was discernible on others. Mud ridges were not present on shells of laboratory reared snails. Fine growth lines provide a minimal amount of shell sculpture. The outer shell surface is dull but the inside is very glossy. There is a well-defined columellar plait and a weakly developed, untwisted columellar fold. The peripheral margin of the shells is rounded with moderately impressed sutures. The holotype (Plate 1) is deposited in the mollusc collection of the British Museum (Natural History) (BMNH No. 1973103). Paratypes (both field collected and laboratory reared) are deposited in the mollusc

collections of both the British Museum (Natural History) (BMNH No. 1973104) and the University of Michigan, Museum of Zoology.

Jaw

The jaw is small but relatively strong. Jaw colour varies from a medium brown to a translucent amber, with darker brown markings on the cutting piece and basal accessory plate (Fig. 5). It is higher than wide when measured at its greatest dimensions. The arms of the cutting piece are rounded with tapering anterior extremities which bend toward the central longitudinal body axis. The anterior margin of the cutting piece is deeply convex with a median prominence varying from scarcely noticeable to conspicuous. The sides of the accessory plate slant slightly inward and the posterior margin is nearly straight with rounded corners.

Radula

The radula formula for *Quickia aldabraensis* is 14-15 : 8-9 : 1 : 8-9 : 14-15. There are usually 8 lateral and 14 marginal teeth. The radula has typical succineid-like features (see Patterson, 1971) and possesses no especially distinctive characters.

External body morphology

The body of living *Quickia aldabraensis*, especially the head-foot region, has a strikingly red coloration. However, all the red colour is lost in alcohol preservation. In both living and preserved snails, the internal organs positioned within the head-foot are visible through the body wall. Black pigmentation on the head-foot and anterior mantle border varies from almost none to a maximum amount shown in Fig. 6. The kidney, visible through both the body wall and shell, is yellow in colour, bi-lobed on the animal's left side and has the shape shown in outline on Fig. 6. The foot of adult, relaxed and preserved specimens is 10-11 mm in length and 4.5-5 mm in width.

Reproductive anatomy

A ventral view of the preserved reproductive system of *Quickia aldabraensis* is shown in Fig. 7. The ovotestis is of moderate size and consists of 70-80 acini. It has a dull, light beige coloration. The ovotestis duct is very narrow as it departs from the ovotestis and has a white colour. It soon becomes distended to serve as the seminal vesicle along most of its length. The seminal vesicle portion is usually coiled once and folded three times along its length. The duct again becomes a narrow channel as it opens into the upper portion of the spermoviduct. There are two subequal, narrow receptacula seminis and a well-developed fecundation pouch (Fig. 8). Both have a translucent white colour. The cream-coloured albumen gland is of moderate size, has a linguiform shape and follicular appearance. The tubules of the albumen gland are approximately one-half the size of ovotestis acini. The spermoviduct and oviduct have a creamy colour and are compactly folded along their length. The inner folds of tissue along the uteral portion of the oviduct are visible through the duct wall. The spermatheca is nearly spherical, of moderate size and cream coloured. Its duct passes along the proximal ventral wall of the uteral portion of the oviduct, courses anteriorly and joins dorsally with the oviduct

at a level slightly posterior to the end of the penis (Fig. 9). Thus, the vagina is quite short in this species. The walls of the anterior portion of the oviduct and vagina become thicker and somewhat muscular in appearance. The prostate gland is of moderate size and white in colour. It is composed of a rather loose collection of tubules (Fig. 10) which were not separable into distinct bunches as in *Q. spurca*. There are many channels opening from the prostate gland into the vas deferens (Fig. 10). The vas deferens passes ventrally and anteriorly from the end of the prostate gland. It then passes dorsally over the oviduct and inserts at the apex of the penis. The penis is a simple sheathless tube approximately 1 mm in length (Fig. 9). It is situated on the right of the vagina in ventral view (Fig. 7). A cross-section shows the inner folds and the lumen of the penis (Fig. 11). The long, thin penial retractor muscle originates adjacent to the vas deferens, passes under the right tentacle assembly and courses posteriorly to its insertion in the tissue covering the anterior portion of the digestive gland. The common reproductive channel (Fig. 7) is usually equal to, or occasionally shorter than, the length of the penis. It has a muscular appearance and opens to the exterior via the oval-shaped genital aperture (Fig. 9).

Chromosome number

The haploid chromosome number of *Quickia aldabraensis* is $n = 25$, the same number observed in *Q. spurca*, *Q. bensoni* and *Q. calcuttensis*, as well as in members of two other unidentified *Quickia* from Tamilnadu, India. Fig. 2 shows a camera lucida drawing of a cell in late meiotic diakinesis. There were no chromosomal anomalies observed in any cells and chromosome pairing appeared to be completely normal.

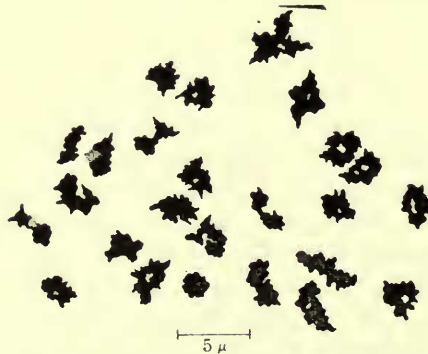
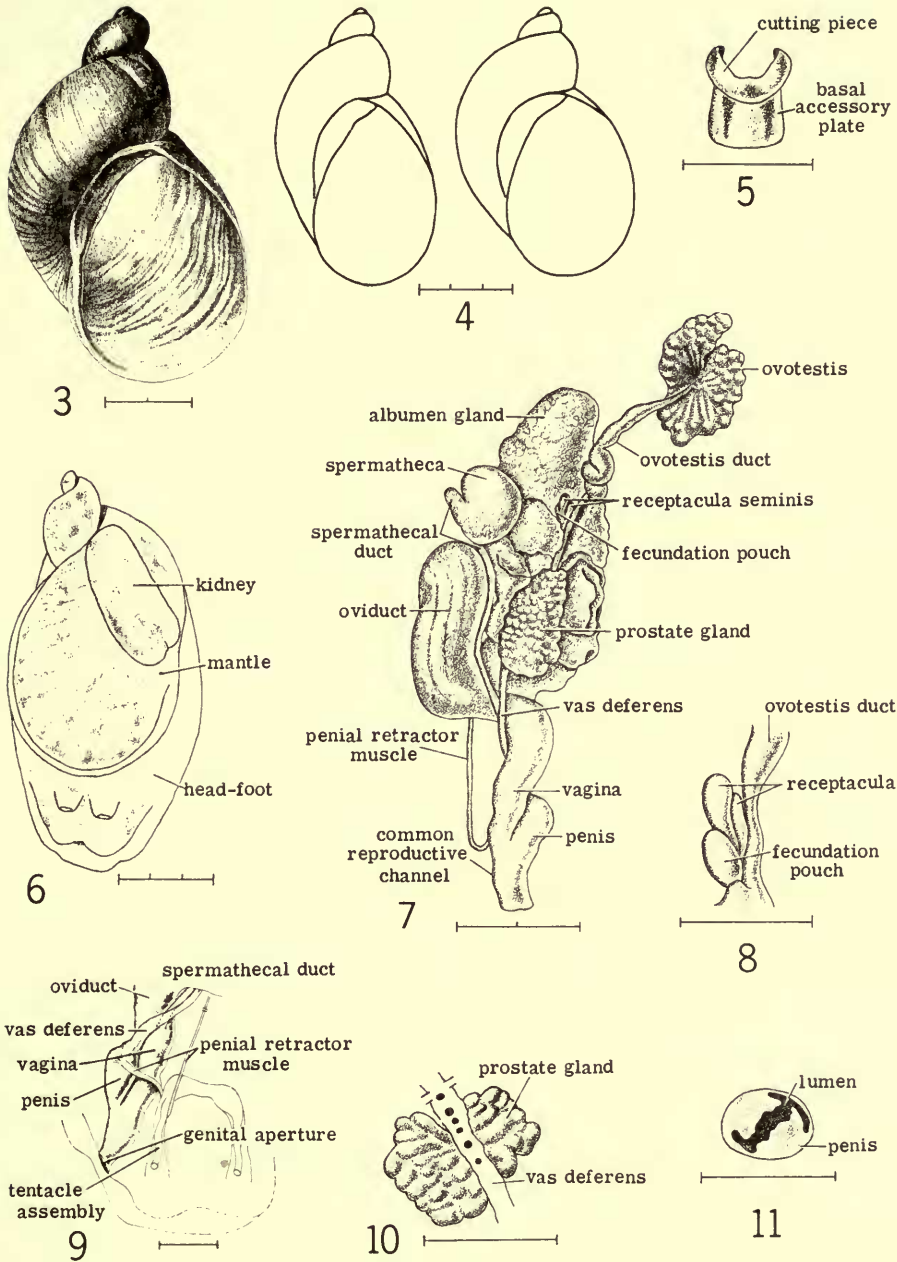


FIG. 2. Meiotic chromosomes of *Quickia aldabraensis*.

DISCUSSION AND TAXONOMY

Prior to 1968, the genus was considered to be monotypic, containing only the type species, *Quickia concisa* (Morelet). Subsequently, '*Succinea*' *spurca* Gould, '*Succinea*' *bensoni* Pfeiffer and a recently discovered Indian species (*Q. calcuttensis* Patterson) have also been found to belong to the genus *Quickia*. *Q. aldabraensis* is now the fifth species included in the genus. The Liberian *Q. spurca* differs in several respects



FIGS 3-11. 3, Shell drawing ; 4, Shell shape variability ; 5, Jaw ; 6, Body pigmentation ; 7, Ventral view of the reproductive tract ; 8, Receptacula complex ; 9, Terminal genitalia ; 10, Prostate gland ; 11, Cross section of the penis.

from *Q. concisa* (Morelet) (Patterson, 1968, 1971). However, *Q. spurca* and *Q. concisa* appear to be more closely related to each other than *Q. aldabraensis* is to either. For comparative purposes, Table 1 gives a short summary description of various distinct morphological and anatomical characters of these three species.¹

TABLE 1

Morphological characters of *Quickia*

character	<i>Q. aldabraensis</i>	<i>Q. spurca</i>	<i>Q. concisa</i>
shell sculpture	non-granulate	granulate	granulate
shell colour	amber to reddish amber	white	white
radula formula	14-15:8-9:1:8-9: 14-15	12-14:9-10:1:9-10: 12-14	11:10:1:10:1
head-foot colour	reddish	translucent white	translucent white
prostate gland	white; branching tubules; relatively large	white; loosely branching tubules; small	yellow; small
receptacula seminis	highly subequal	slight subequal to equal	slightly subequal to equal
penis position (ventral view)	right of vagina	usually left of vagina	left of vagina
penial retractor muscle insertion	posteriorly	posteriorly	anteriorly

Connolly (1925) mentioned the collection of *Succinea mascarenensis* Nevill (Morelet) Nevill from Grand Terre, Aldabra Island. Apparently this is the only occasion of assigning a name to the Aldabran succineid. Madge (1938) correctly established that '*S. nevellei* Crosse' and '*S. mascarenensis* Nevill' are synonyms of '*S. concisa*'. He further stated that '*S. mascarenensis* Nevill (Morelet)' is probably also a synonym of '*S. concisa*'. However, the name *mascarenensis* used by Morelet (1882) does not have validity since his name was an alteration of Nevill's name *mascarenensis* and, according to Madge (1938), was based on a mis-identification because the specimens were not comparable to those of Nevill. *Quickia aldabraensis* is thus the second valid species of the genus known to inhabit Indian Ocean islands.

The presence of mud ridges on shells of *Quickia concisa* has, in the past, been a key character used in its identification. However, the presence of mud ridges on shells of live field-collected *Q. aldabraensis* indicates they cannot be used as a valid species

¹ Descriptions of *Q. concisa* are taken from Quick (1936) and Odhner (1950). I have verified the anterior insertion of the penial retractor muscle in *Q. concisa*, but the specimens were otherwise unsuitable for a more complete anatomical study.

specific character of *Q. concisa*. From my examination of a specimen of *Q. concisa* from Rodriguez and published results of Quick's (1936) observations of *Q. concisa* from various localities, the most reliable species specific character for *Q. concisa* is the anterior insertion of a short penial retractor muscle. *Q. concisa* appears to be the only succineid species, studied to date, with such a condition. Based on present information, the accompanying key indicates the most reliable characters for identification of currently recognized *Quickia* species.

All species of *Quickia* are distinct, although *Q. bensoni* from India and *Q. spurca* from Liberia, while being the most widely separated geographically, appear to be the most closely related (morphologically) of the species. There is an indication that *Q. concisa* is rather distantly related to *Q. spurca* and *Q. bensoni*. *Q. calcuttensis* and *Q. aldabraensis* have evolved to be most different from the other species. It is difficult at this time to ascertain the relationship between the latter two species.

Quickia has the highest chromosome number known in the family Succineidae. Data for the Subclass Euthyneura indicate that generally higher chromosome numbers are associated with snail taxa which are considered morphologically more advanced by systematists (see Burch, 1965; Patterson, 1969). Odhner (1950) stated that '*Quickia* and *Indosuccinea* evidently both represent a more primitive stage of the male genital development than exists in the other species of the Catinellinae and indeed the most archaic type of male organ in any of the Succineidae hitherto examined'. One is now forced to consider whether simplification of the terminal reproductive system is instead a morphologically more advanced stage of evolutionary development which was accompanied by an increase in chromosome number derived through aneuploidy over a long period of time. *Indosuccinea* has a more simplified terminal male genital development but a lower chromosome number ($n = 24$) than *Quickia*. *Indosuccinea* could have experienced an aneuploid reduction of one (or more) bivalent(s) from a higher chromosome number or evolved in its own direction from a predecessor with a lower chromosome number. The question of the evolutionary relationship of the various succineid genera is unsettled, especially in the Catinellinae (see Patterson, 1972).

KEY TO QUICKIA SPECIES

1a	Penial apron present	Subgenus <i>Burchella</i>	
		<i>Quickia calcuttensis</i> Patterson	
1b	Penial apron absent	Subgenus <i>Quickia</i> s. s.	2
2a	Shell amber and without granulations	<i>Q. aldabraensis</i> sp. n.	
2b	Shell white and granulate		3
3a	Penial retractor muscle inserts anteriorly	<i>Q. concisa</i> (Morelet)	
3b	Penial retractor muscle inserts posteriorly		4
4a	Tubules of prostrate gland very loosely organized	<i>Q. spurca</i> (Gould)	
4b	Tubules of prostrate gland more compactly organized	<i>Q. bensoni</i> (Pfeiffer)	

DISTRIBUTION AND BIOLOGY

Fig. 12 shows the known distribution of *Quickia*. *Q. concisa* appears to have the broadest distribution. However, anatomical validation of the species from many areas is necessary to substantiate such a vast distribution determined largely from

identifications often based only on shell characters. There are no records of the occurrence of *Q. aldabraensis* on any island in the Indian Ocean other than Aldabra Atoll. It would be interesting to know if additional *Quickia* species have evolved in other island groups.

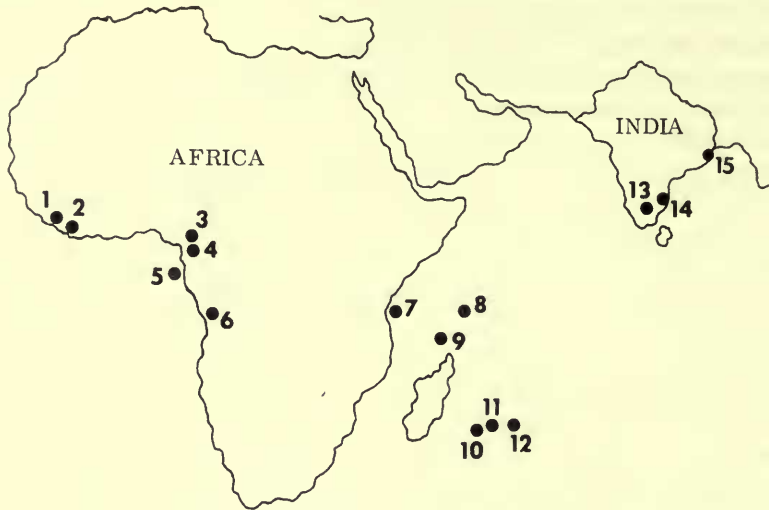


FIG. 12. Distribution map of *Quickia*.

- *1, Sierra Leone
- 2, Liberia
- *3, Cameroon
- *4, Gabon
- *5, San Thome

- *6, Angola
- *7, Zanzibar
- *8, Seychelles
- 9, Aldabra
- *10, La Réunion

- *11, Mauritius
- *12, Rodriquez
- 13, Tamilnadu State
- 14, Tamilnadu State
- 15, Calcutta

* Denotes localities for *Quickia concisa*.

Most succineids occupy relatively damp or humid habitats, some near sources of permanent fresh water. Two species (*Lithotis rupicola* Blandford and *Succinea bernardii* Récluz) are actually found in running water of falls (Patterson, 1973b). Some tropical succineids are arboreal. *Quickia* is interesting because some of its species are adapted to areas devoid of permanent standing or running water. These species depend only on seasonal rains for moisture. Usually the snails are found on rocks or rock walls or in crevices where they seek shelter in hot, dry weather. Apparently they are able to aestivate for long periods of time (one year or more) in the absence of monsoon rains. *Q. calcuttensis* from Calcutta and two other populations of *Quickia* located in Tamilnadu (Madras), India do inhabit moist areas adjacent to sources of permanent fresh water. Because of its adaptability, *Quickia* has been able to colonize areas which would seem to be unsuitable habitats for succineids. Further zoogeographical studies may reveal a much wider distribution of *Quickia*. It would be particularly interesting to know if *Quickia* occurs in Australia or if the Australian succineids living in dry habitats (i.e. *Arborcinia*) are related to *Quickia*.

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SUMMARY

- (1) A morphological-anatomical description of *Quickia aldabraensis*, a new species from Aldabra Atoll, is presented.
- (2) The chromosome number of *Q. aldabraensis* is $n = 25$, the same number characteristic of other *Quickia* species.
- (3) *Quickia* occurs in Africa, on some Indian Ocean islands and in India.
- (4) Based on morphological studies, *Quickia* species do not seem to be particularly closely related to each other.
- (5) Members of the genus *Quickia* occupy a variety of habitats including those which are extremely dry while other species are found near areas of permanent fresh water.

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C. M. PATTERSON
 Museum of Zoology
 THE UNIVERSITY OF MICHIGAN
 ANN ARBOR, MICHIGAN 48104
 U.S.A.

PLATE I

Holotype of *Quickia aldabraensis*

a, Holotype (BMNH No. 1973103) collected from the type locality (1968).

b, Paratype (BMNH No. 1973104) laboratory reared. Measurement line in mm.